

CLAIMSWhat is claimed is:

1. A glow plasma discharge apparatus for generating and maintaining a glow plasma discharge comprising:
  - 5 a pair of electrodes positioned in facing relation having a space there between;
  - a perforated dielectric having a plurality of apertures of micron dimension placed over one of the electrodes and partially occupying the space; and
  - 10 an electric field generated between the electrodes.
2. The apparatus of claim 1 wherein the perforated dielectric comprises a plurality of apertures, each aperture having a diameter ranging from 5 to 200 $\mu$ m.
- 15 3. The apparatus of claim 2 wherein the dielectric is between 100 $\mu$ m and 2mm in thickness.
4. The apparatus of claim 1 wherein the dielectric comprises silicon nitride.
- 20 5. The apparatus of claim 1 wherein the dielectric comprises silicon carbide.
6. The apparatus of claim 1 wherein a second dielectric is placed over the other of the electrodes.
- 25 7. The apparatus of claim 1 wherein the dielectric is a high temperature dielectric able to withstand high temperatures.
8. A cathode in a glow plasma discharge apparatus for generating and maintaining a glow plasma discharge comprising:
  - 30 an electrode;

current limiting means having a plurality of apertures of micron dimension placed over the electrode for limiting current density associated with the electrode; and

means for retaining the current limiting on the electrode.

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9. The apparatus of claim 8 wherein the apertures have a diameter ranging from 5 to 200 $\mu$ m.

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10. The apparatus of claim 9 wherein the current limiting means is between 100 $\mu$ m and 2mm in thickness.

11. The apparatus of claim 8 wherein the current limiting means comprises silicon nitride.

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12. The apparatus of claim 8 wherein the current limiting means comprises silicon carbide.

13. The apparatus of claim 8 wherein a second current limiting means is placed over the other of the electrodes.

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14. The apparatus of claim 8 wherein the current limiting means is a high temperature dielectric able to withstand high temperatures.

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15. A glow plasma discharge apparatus for generating and maintaining a glow plasma discharge comprising:

a pair of electrodes positioned in facing relation;

an electric field generated between the electrodes; and

a dielectric having a plurality of apertures of micron dimension positioned between the electrodes, the apertures sized to limit current density between the electrodes from increasing above a pre-determined threshold.

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16. The apparatus of claim 15 further comprising collar means for retaining the dielectric on one of the electrodes.

5 17. The apparatus of claim 15 wherein the dielectric is formed integrally with one of the electrodes.

18. A method of generating and maintaining a glow plasma discharge comprising the steps of:

10 positioning opposing electrodes in a facing relation with a space therebetween;

providing within the space a perforated dielectric having a plurality of apertures of micron dimension; and

generating an electric field between the electrodes.

15 19. The method of claim 18 further comprising the step of providing a second perforated dielectric having a plurality of apertures of micron dimension within the space.

20 20. The method of claim 18 wherein the step of positioning the perforated dielectric with the space further comprises placing the perforated dielectric on an electrode and retaining the dielectric thereon.

25 21. The method of claim 20 wherein the step of retaining the dielectric on one of the electrodes further includes the step of placing a retaining collar over the dielectric.

22. The method of claim 18 wherein the step of positioning the perforated dielectric within the space comprises the step of depositing a dielectric on one of the electrodes.

30 23. The method of claim 22 wherein the step of depositing a dielectric on one of the electrodes comprises vapor deposition.